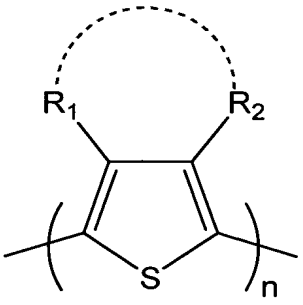
CLAIMS

1. A fabrication method of a photoelectric conversion device comprising a semiconductor electrode and a metal film to be an opposite electrode formed on a metal oxide film, wherein the method includes steps of forming an intermediate film comprising at least one compound selected from polythiophene defined by the following Formula 1 and its derivatives as well as polystyrenesulfonic acid defined by the following Formula 2, RSO_3H (R = an alkyl, an aryl or an alkoxy), $R'OSO_3H$ (R' = H, an alkyl, an aryl or an alkoxy), HCl, $HClO_4$, HPF_6, HBF_4, and HI_5 on the metal oxide film and forming the metal film on the intermediate film:

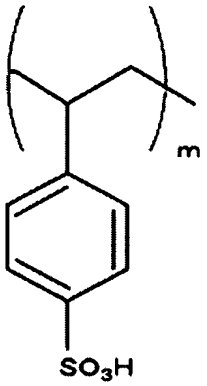
[Formula 1]



R_1, R_2 = H, an alkyl, an aryl or an alkoxy

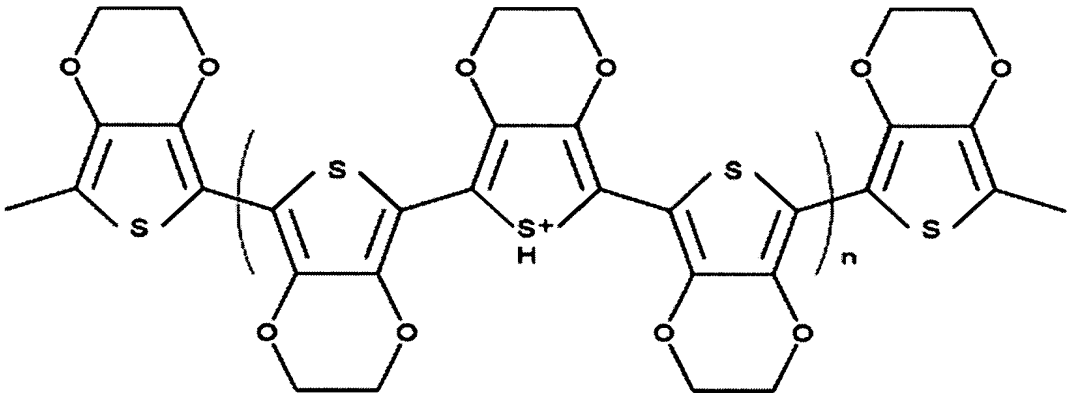
= a cyclic structure

[Formula 2]

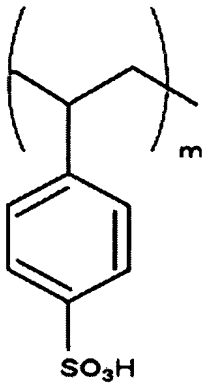


2. The fabrication method of a photoelectric conversion device as claimed in claim 1, wherein the intermediate film is composed of polyethylene dioxythiophene defined by the following Formula 3 and polystyrenesulfonic acid defined by the following Formula 4:

[Formula 3]

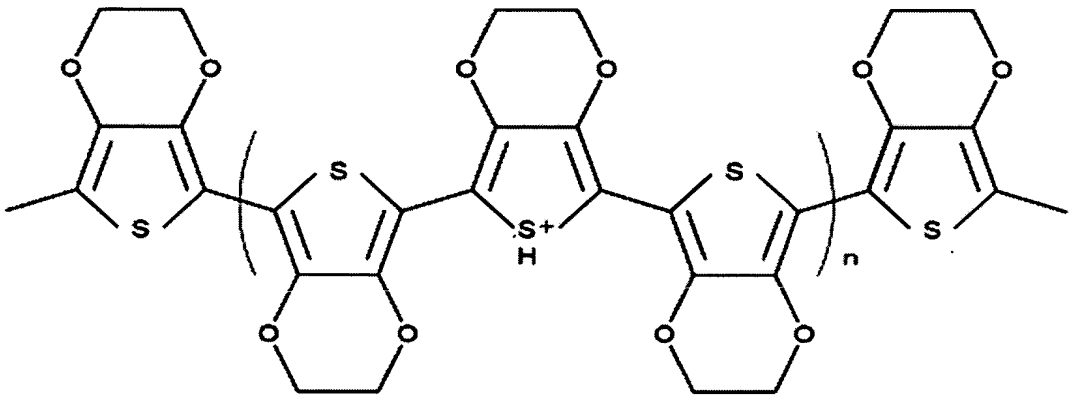


[Formula 4]

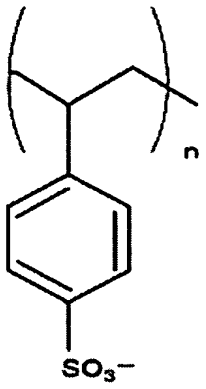


3. The fabrication method of a photoelectric conversion device as claimed in claim 1, wherein the intermediate film is formed by using an aqueous solution containing polyethylene dioxythiophene defined by the following Formula 5, polystyrenesulfonic acid ion defined by the following Formula 6, and polystyrenesulfonic acid defined by the following Formula 7:

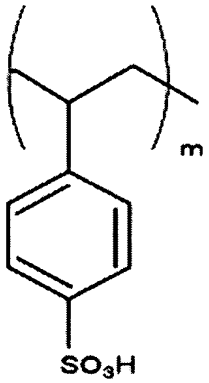
[Formula 5]



[Formula 6]



[Formula 7]



4. The fabrication method of a photoelectric conversion device as claimed in claim 1, wherein metal oxide film is made of at least one metal oxide selected from In-Sn oxide, SnO_2, TiO_2, and ZnO.

5. The fabrication method of a photoelectric conversion device as claimed in claim 1, wherein the metal film is made of at least one metal selected from platinum, gold, aluminum, copper, silver and titanium.

6. The fabrication method of a photoelectric conversion device as claimed in claim 1, wherein the metal film is

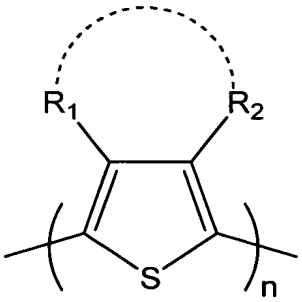
a monolayer film or a multilayer film made of at least one metal selected from platinum, gold, aluminum, copper, silver and titanium.

7. The fabrication method of a photoelectric conversion device as claimed in claim 1, wherein the semiconductor electrode is composed of semiconductor fine particles.

8. The fabrication method of a photoelectric conversion device as claimed in claim 1, wherein the photoelectric conversion device is a wet type solar cell.

9. A photoelectric conversion device comprising a semiconductor electrode and a metal film to be an opposite electrode formed on a metal oxide film, wherein an intermediate film comprising at least one compound selected from polythiophene defined by the following Formula 8 and its derivatives as well as polystyrenesulfonic acid defined by the following Formula 9, RSO_3H (R = an alkyl, an aryl or an alkoxy), $R'OSO_3H$ (R' = H, an alkyl, an aryl or an alkoxy), HCl, $HClO_4$, HPF_6, HBF_4, and HI_5 is formed on the metal oxide film and the metal film is formed on the intermediate film:

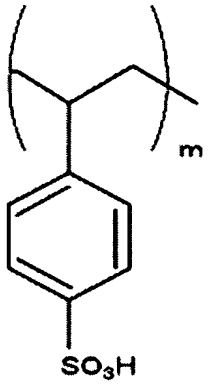
[Formula 8]



R_1, R_2 = H, an alkyl, an aryl or an alkoxy

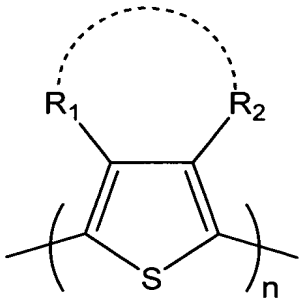
= a cyclic structure

[Formula 9]



10. A manufacturing method of an electronic apparatus comprising a metal film formed on a metal oxide film wherein the method includes steps of forming an intermediate film comprising at least one compound selected from polythiophene defined by the following Formula 10 and its derivatives as well as polystyrenesulfonic acid defined by the following Formula 11, RSO_3H (R = an alkyl, an aryl or an alkoxy), $R'OSO_3H$ (R' = H, an alkyl, an aryl or an alkoxy), HCl, $HClO_4$, HPF_6, HBF_4, and HI_5 on the metal oxide film and forming the metal film on the intermediate film:

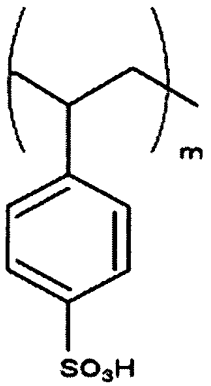
[Formula 10]



R_1, R_2 = H, an alkyl, an aryl or an alkoxy

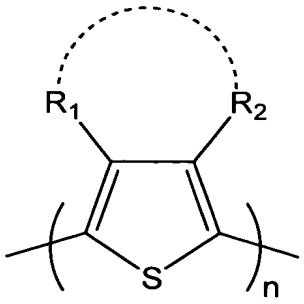
= a cyclic structure

[Formula 11]



11. An electronic apparatus comprising a metal film formed on a metal oxide film wherein an intermediate film comprising at least one compound selected from polythiophene defined by the following Formula 12 and its derivatives as well as polystyrenesulfonic acid defined by the following Formula 13, RSO_3H (R = an alkyl, an aryl or an alkoxy), $R'OSO_3H$ (R' = H, an alkyl, an aryl or an alkoxy), HCl, $HClO_4$, HPF_6, HBF_4, and HI_5 is formed on the metal oxide film and the metal film is formed on the intermediate film:

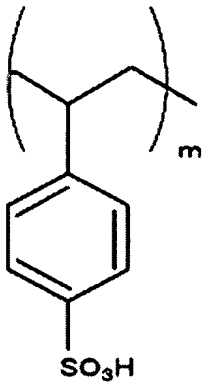
[Formula 12]



R_1, R_2 = H, an alkyl, an aryl or an alkoxy

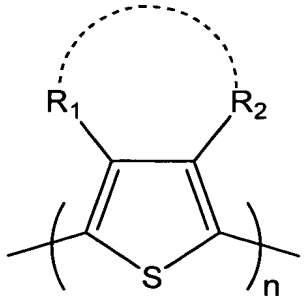
= a cyclic structure

[Formula 13]



12. A metal film formation method for forming a metal film on a metal oxide film, wherein the method includes steps of forming an intermediate film comprising at least one compound selected from polythiophene defined by the following Formula 14 and its derivatives as well as polystyrenesulfonic acid defined by the following Formula 15, RSO_3H (R = an alkyl, an aryl or an alkoxy), $R'OSO_3H$ (R' = H, an alkyl, an aryl or an alkoxy), HCl, $HClO_4$, HPF_6, HBF_4, and HI_5 on the metal oxide film and forming the metal film on the intermediate film:

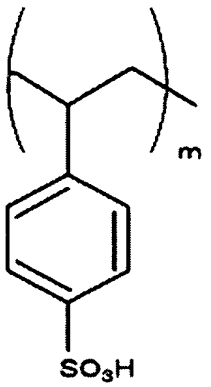
[Formula 14]



R_1, R_2 = H, an alkyl, an aryl or an alkoxy

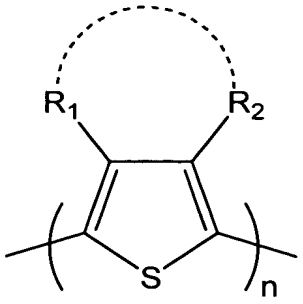
= a cyclic structure

[Formula 15]



13. A layer structure comprising a metal film formed on a metal oxide film, wherein an intermediate film comprising at least one compound selected from polythiophene defined by the following Formula 16 and its derivatives as well as polystyrenesulfonic acid defined by the following Formula 17, RSO_3H (R = an alkyl, an aryl or an alkoxy), $R'OSO_3H$ (R' = H, an alkyl, an aryl or an alkoxy), HCl, $HClO_4$, HPF_6, HBF_4, and HI_5 is formed on the metal oxide film and the metal film on the intermediate film:

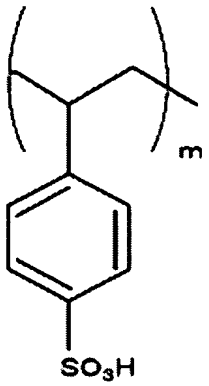
[Formula 16]



R_1, R_2 = H, an alkyl, an aryl or an alkoxy

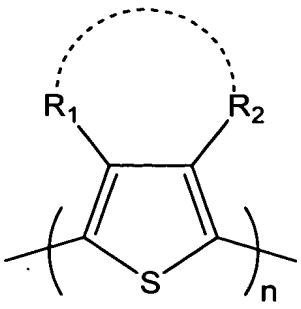
= a cyclic structure

[Formula 17]



14. A fabrication method of a photoelectric conversion device comprising a semiconductor electrode composed of semiconductor fine particles on a metal oxide film, wherein the method includes steps of forming an intermediate film comprising at least one compound selected from polythiophene defined by the following Formula 18 and its derivatives as well as polystyrenesulfonic acid defined by the following Formula 19, RSO_3H (R = an alkyl, an aryl or an alkoxy), $R'OSO_3H$ (R' = H, an alkyl, an aryl or an alkoxy), HCl, $HClO_4$, HPF_6, HBF_4, and HI_5 on the metal oxide film and forming the semiconductor electrode on the intermediate film:

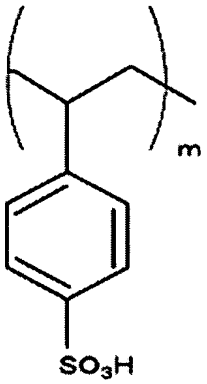
[Formula 18]



R_1, R_2 = H, an alkyl, an aryl or an alkoxy

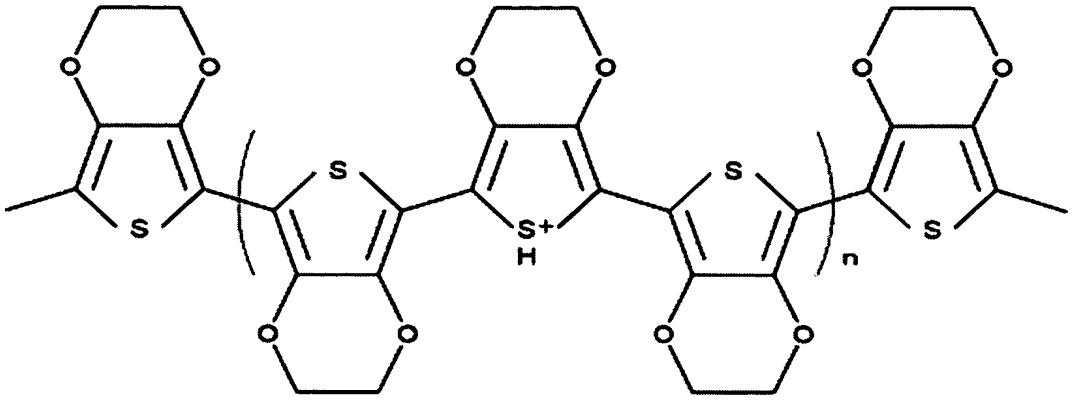
= a cyclic structure

[Formula 19]

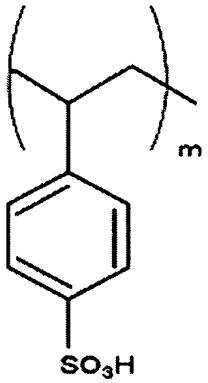


15. The fabrication method of a photoelectric conversion device as claimed in claim 14, wherein the intermediate film is composed of polyethylene dioxythiophene defined by the following Formula 20 and polystyrenesulfonic acid defined by the following Formula 21:

[Formula 20]

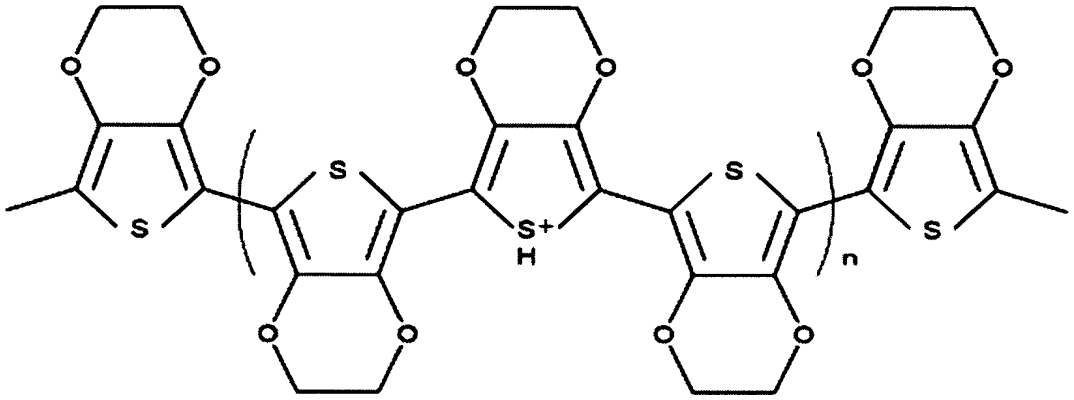


[Formula 21]

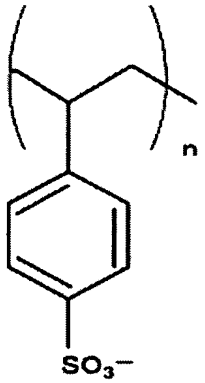


16. The fabrication method of a photoelectric conversion device as claimed in claim 14, wherein the intermediate film is formed by using an aqueous solution containing polyethylene dioxythiophene defined by the following Formula 22, polystyrenesulfonic acid ion defined by the following Formula 23, and polystyrenesulfonic acid defined by the following Formula 24:

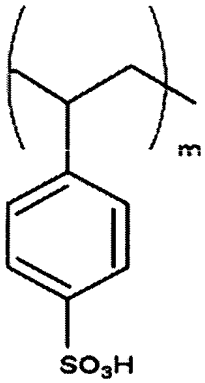
[Formula 22]



[Formula 23]



[Formula 24]



17. The fabrication method of a photoelectric conversion

device as claimed in claim 14, wherein metal oxide film is made of at least one metal oxide selected from In-Sn oxide, SnO_2, TiO_2, and ZnO.

18. The fabrication method of a photoelectric conversion device as claimed in claim 14, wherein the metal oxide film is formed on a transparent plastic substrate.

19. The fabrication method of a photoelectric conversion device as claimed in claim 14, wherein the semiconductor electrode is formed by using a strongly acidic semiconductor fine particle dispersion.

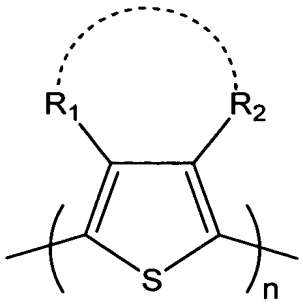
20. The fabrication method of a photoelectric conversion device as claimed in claim 14, wherein the semiconductor electrode is formed at a temperature not lower than 100°C and not higher than 140°C.

21. The fabrication method of a photoelectric conversion device as claimed in claim 14, wherein the photoelectric conversion device is a wet type solar cell.

22. A photoelectric conversion device comprising a semiconductor electrode composed of semiconductor fine particles on a metal oxide film wherein an intermediate film comprising at least one compound selected from polythiophene defined by the following Formula 25 and its derivatives as well as polystyrenesulfonic acid defined by the following Formula 26, RSO_3H (R = an alkyl, an aryl or an alkoxy), $R'OSO_3H$ (R' = H, an alkyl, an aryl or an alkoxy), HCl, $HClO_4$, HPF_6, HBF_4, and HI_5 is formed on the metal oxide film and the semiconductor electrode is formed

on the intermediate film:

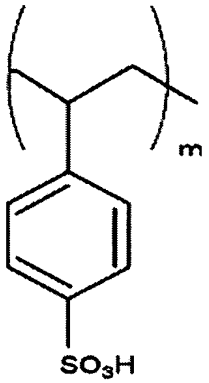
[Formula 25]



R_1, R_2 = H, an alkyl, an aryl or an alkoxy

= a cyclic structure

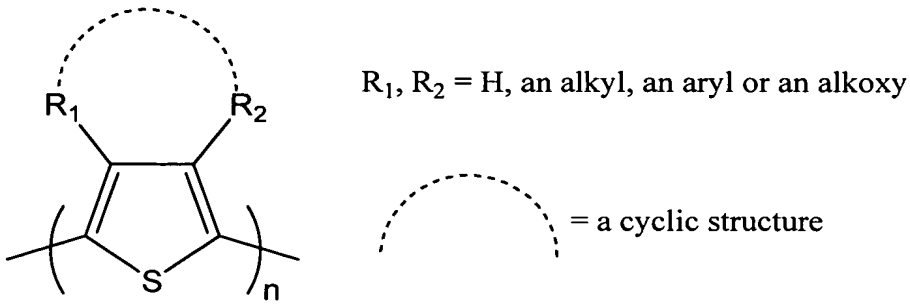
[Formula 26]



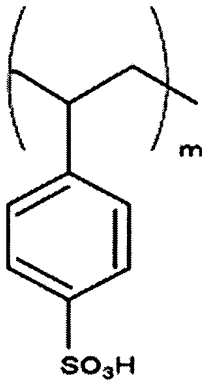
23. A manufacturing method of an electronic apparatus comprising a semiconductor electrode composed of semiconductor fine particles on a metal oxide film wherein the method includes steps of forming an intermediate film comprising at least one compound selected from polythiophene defined by the following Formula 27 and its derivatives as well as polystyrenesulfonic acid defined by the following Formula 28, RSO_3H (R = an alkyl, an aryl or an alkoxy), $R'OSO_3H$ (R' = H, an alkyl, an aryl or an

alkoxy), HCl, $HClO_4$, HPF_6, HBF_4, and HI_5 on the metal oxide film and forming the semiconductor electrode on the intermediate film:

[Formula 27]



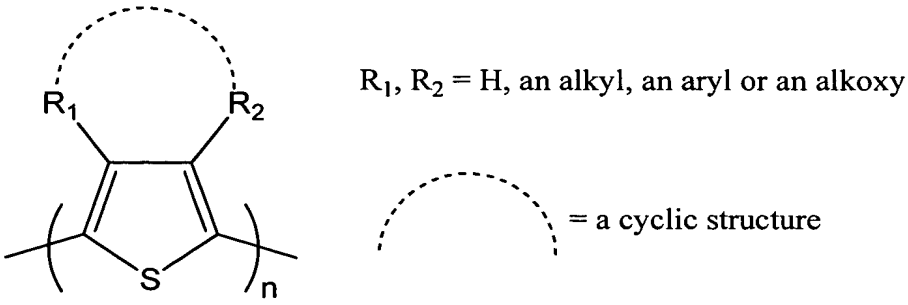
[Formula 28]



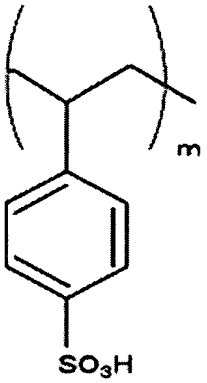
24. An electronic apparatus comprising a semiconductor electrode composed of semiconductor fine particles on a metal oxide film wherein an intermediate film comprising at least one compound selected from polythiophene defined by the following Formula 29 and its derivatives as well as polystyrenesulfonic acid defined by the following Formula 30, RSO_3H (R = an alkyl, an aryl or an alkoxy),

$R'OSO_3H$ (R' = H, an alkyl, an aryl or an alkoxy), HCl, $HClO_4$, HPF_6, HBF_4, and HI_5 is formed on the metal oxide film and the semiconductor electrode is formed on the intermediate film:

[Formula 29]



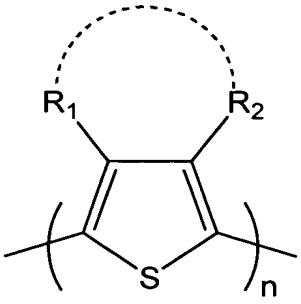
[Formula 30]



25. A semiconductor fine particle layer formation method for forming a semiconductor fine particle layer on a metal oxide film wherein the method includes steps of forming an intermediate film comprising at least one compound selected from polythiophene defined by the following Formula 31 and its derivatives as well as

polystyrenesulfonic acid defined by the following Formula 32, RSO_3H (R = an alkyl, an aryl or an alkoxy), $R'OSO_3H$ (R' = H, an alkyl, an aryl or an alkoxy), HCl, $HClO_4$, HPF_6, HBF_4, and HI_5 on the metal oxide film and forming the semiconductor fine particle layer on the intermediate film:

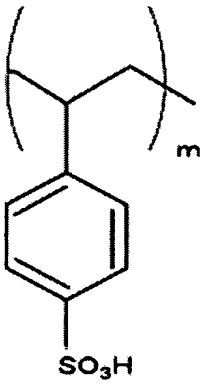
[Formula 31]



R_1, R_2 = H, an alkyl, an aryl or an alkoxy

= a cyclic structure

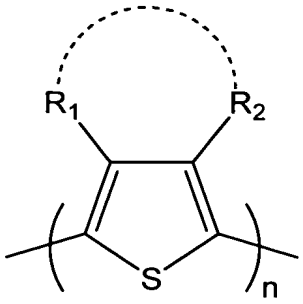
[Formula 32]



26. A layer structure comprising a semiconductor fine particle layer on a metal oxide film wherein an intermediate film comprising at least one compound selected from polythiophene defined by the following Formula 33 and its

derivatives as well as polystyrenesulfonic acid defined by the following Formula 34, RSO_3H (R = an alkyl, an aryl or an alkoxy), $R'OSO_3H$ (R' = H, an alkyl, an aryl or an alkoxy), HCl, $HClO_4$, HPF_6, HBF_4, and HI_5 is formed on the metal oxide film and the semiconductor fine particle layer is formed on the intermediate film:

[Formula 33]



R_1, R_2 = H, an alkyl, an aryl or an alkoxy

= a cyclic structure

[Formula 34]